Volume 12, Number 1

January 1999

JTSTEB 12(1) 1–210 (1999)

ISSN 0894-9867

Journal of Traumatic Stress

KLUWER ACADEMIC / PLENUM PUBLISHERS

Journal of Traumatic Stress, Vol. 12, No. 1, 1999

Modeling Physical Health and Functional Health Status: The Role of Combat Exposure, Posttraumatic Stress Disorder, and Personal Resource Attributes

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This study examined associations of combat exposure and posttraumatic stress disorder (PTSD) with physical health conditions and also incorporated hardiness and social support as mediators and functional health status as an outcome. Data were derived from 1,632 male and female Vietnam veterans who participated in the National Vietnam Veterans Readjustment Study. Path analysis revealed that hardiness and social support operated primarily as intermediary variables between combat exposure and PTSD, and PTSD emerged as the pivotal variable explaining physical health conditions and functional health status. Gender-based differences in means and patterns of associations among variables were found. The results stress the importance of assessing trauma in clinical settings as a meaningful determinant of health outcomes.

KEY WORDS: posttraumatic stress disorder; combat exposure; functional health; hardiness; social support.

There is increased interest in the associations of both exposure to highly stressful events and posttraumatic stress disorder (PTSD) with poor

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0894-9867/99/0100-0003$16.00/1

physical health. In this regard, Wolfe, Schnurr, Brown, and Furey (1994) examined the unique relationships of both war-zone exposure and PTSD with physical health in female Vietnam veterans. When controlling for war-zone exposure, the relationship between PTSD and physical health was virtually unchanged; when controlling for PTSD, however, the effect of war-zone exposure was greatly reduced. The study implicates PTSD as a larger independent contributor to poor physical health than war-zone exposure. Applying path analysis to the same female veteran data, Friedman and Schnurr (1995) tested the direct effects of both war-zone exposure and PTSD on physical health, as well as the indirect effect of war-zone exposure through PTSD. Their results augmented those of Wolfe et al.: PTSD had a significant mediational function in the relationship between war-zone exposure and physical health.

In this study, we examined associations among war-related stressors, PTSD, and physical health using path analytic techniques with data from a large, national community-based sample of military veterans, the National Vietnam Veterans Readjustment Study (NVVRS; Kulka et al., 1990). We broadened inquiry by: (1) incorporating the personal resources of hardiness and perceived social support as mediators; (2) distinguishing physical health from functional health status, with functional health status as a terminal variable in the system of relationships; and (3) including both men and women in the sample. An overriding goal was to go beyond PTSD as the criterion variable of interest and examine its role in accounting for possible ill health and reduction in the capacity to perform daily tasks. While a number of prior secondary analyses have used the NVVRS database (e.g., Fontana & Rosenheck, 1994; Fontana, Schwartz, & Rosenheck, 1997; King, King, Fairbank, Keane, & Adams, 1998; King, King, Foy, Keane, & Fairbank, in press) and have examined some of the variables used in this study (combat exposure, hardiness, and social support), the aim of the investigation was to use this valuable resource to link mental and physical aspects of health.

The personality construct of hardiness (Kobasa, 1979) is characterized by a feeling of control over one's life, a belief that change is a positive force for personal growth and development, and a sense of commitment to one's life activities. It has been recognized as conceptually linked to [non] negative affectivity (Funk, 1992; Rhodewalt & Zone, 1989), a contemporary personality trait that appears to be important in understanding the effects of stress on mental and physical health (Watson & Pennebaker, 1989). Hardiness has been shown to be related to physical health indicators. Kobasa's high stress/low illness male executives, for example, displayed more hardiness than did her group of high stress/high illness male executives. Also, both using low magnitude stressor tasks, Contrada (1989) found

less blood pressure reactivity among men higher in hardiness, and Wiebe (1991) documented larger heart rate elevations for low-hardy men. In addition, Kobasa, Maddi, and Kahn (1982), using a prospective design, found hardiness served as a buffer between stressor level and physical health in male executives.

Concerning the covariation of hardiness and mental health, specifically PTSD, Sutker, Davis, Uddo, and Ditta (1995) reported a direct negative relationship between the commitment aspect of hardiness and PTSD among members of military units who served in the Persian Gulf War. Additionally, King et al. (1998) examined associations among several war-zone stressor dimensions, hardiness, and PTSD using the NVVRS data. Consistent with Sutker et al.'s findings, hardiness had a direct effect on PTSD. Hardiness also was a strong mediator in the relationship between war-zone stressors and PTSD, both as an intermediary variable in its own right and through its association with postwar social support.

Perceived social support, our second personal resource variable of interest, has long been acknowledged as an important influence on physical and mental health (e.g., Cobb, 1976; Cohen & Matthews, 1987; Cohen & Wills, 1985; Sarason & Sarason, 1985). In an early review article, Cobb (1976) endorsed the view that social support ameliorates the effects of stress, including war-related stress, on health. Similarly, Kimerling and Calhoun (1994) observed that higher levels of social support appeared to alleviate physical symptoms and enhance perceived health for a sample of sexual assault victims. Cook and Bickman (1990) found lack of social support was related to somatization, depression, and anxiety within a sample of flood victims. Additionally, King et al. (1998) reported that social support mediated the relationship between war-zone stressors and PTSD for the NVVRS sample, a result consistent with previous research on military veterans (e.g., Card, 1987; Egendorf, Kadushin, Laufer, Rothbart, & Sloan, 1981; Frye & Stockton, 1982; Keane, Scott, Chavoya, Lamparski, & Fairbank, 1985; Solomon & Mikulincer, 1990).

Thus, a working hypothesis of this study was that the personal resources of hardiness and social support would intervene in the relationships between combat exposure and mental and physical health outcomes. In addition to mediating the relationship between combat exposure and PTSD (as demonstrated by King et al., 1998), these personal resource variables were expected to mitigate the influence of combat exposure on physical health conditions, both directly and indirectly through PTSD. Moreover, hardiness was predicted to relate to PTSD and, more importantly, to physical health conditions via its association with social support, because hardy individuals may be more capable of marshaling health-promoting support from those around them (Ganellan & Blaney, 1984).

It should be noted that our expectations regarding the mediational model for these personal resources included both their function as positive influences on health in the form of coping and resilience factors and their susceptibility to depletion after exposure to highly stressful events, like combat. This pattern of relationships refers to Kaniasty and Norris's (1993; Kaniasty, Norris, & Murrell, 1990; Norris & Kaniasty, 1996) deterioration model applied to social support among disaster victims. These researchers argued that stressful events and social support are not independent of each other, and that severe stressors affect perceptions of available support. General disillusionment and other troubles that often accompany exposure to highly negative experiences, especially those extending over time, may color one's interpretations of the helpful behavior of others, thereby producing a deterioration in perceived social support. Those lowered perceptions, in turn, adversely affect physical and mental well-being. Likewise, highly stressful life events might deplete the personal resource of hardiness (King et al., 1998). Again, in the presence of extreme stressors, one's sense of coherence, mastery over day-to-day life, and optimism are likely to diminish. Certainly, for some military personnel, several to many months of service in a war zone might diminish one's vitality and outlook on life and result in a diminution in hardiness. Perceptions of a lack of social support and feelings of loss of control over one's life in the immediate postwar period could subsequently become an engrained pattern of behavioral and emotional responding with long-term consequences.

As noted earlier, this study also focused on functional health status, or the ability of an individual to perform routine self-care tasks and daily physical activities. Functional health status is recognized as an important index of one's likelihood to need health services and is frequently employed as an eligibility criterion to determine the allocation of limited resources (Kane, Saslow, & Brundage, 1991; Stone & Murtaugh, 1990). Lyness, Caine, Conwell, King, and Cox (1993) suggested that physical health conditions and functional health status are correlated, yet distinct constructs. Hence, the model tested in this study included patterns of relationships among the various antecedent variables and functional health status that paralleled patterns of relationships for physical health conditions. In particular, we expected hardiness and social support to mediate the combat exposure-functional health status relationship and PTSD to have a direct effect on functional health status. Finally, the physical health conditions variable was postulated to predict functional health status, allowing PTSD to have an indirect link to functional health status through its association with physical health conditions.

We examined gender separately, that is, tested our model independently for male and female veterans, for several reasons. First, the

populations represented by the male and female subsamples of the NVVRS are quite different from one another (see Kulka et al., 1990, for extensive details). For the most part, the women were older, more educated, and more established in their careers; they represented a group that served in the military voluntarily and almost exclusively as commissioned officers. The men were younger on average, and more diverse in most demographic characteristics; they were both volunteers and conscripts and predominantly from the enlisted ranks. Second (and related to the first reason), prior multivariate analyses of this data set have yielded gender-based differences in the patterns of relationships among variables (e.g., King, King, Gudanowski, & Vreven, 1995; King, King, Foy, & Gudanowski, 1996; King et al., 1998). Finally, the literature on health and illness indicates gender differences in symptomatology and suggests that patterns of relationships among causal factors differ across gender (e.g., Cleary, Mechanic, & Greenley, 1982; Gove, 1984; Verbrugge, 1985, 1989).

Method

Participants

Data were obtained from the National Vietnam Veterans Readjustment Study (NVVRS; Kulka et al., 1990), a Congressionally-mandated investigation that examined the mental and physical health and general life adjustment of Vietnam veterans. The primary data-gathering component of the NVVRS was the National Survey of the Vietnam Generation, which included face-to-face interviews with 1,632 Vietnam veterans, 74% (n = 1,200) of whom were men and 26% (n = 432) of whom were women. These individuals had served one or more tours of active duty in the U.S. armed forces in Vietnam, Laos, or Cambodia or surrounding waters sometime between August 1964 and May 1975. The NVVRS researchers took steps to ensure the sample would be broader and more inclusive than samples in previous studies of Vietnam veterans. African American men (25% of the set of 1,200 men), Hispanic American men (24% of all male participants), and veterans with service-connected disabilities (19% of all those Vietnam veterans interviewed) were oversampled. Also, the NVVRS was the first large-scale national study to include a significant representation of female Vietnam veterans, primarily registered nurses. All branches of the armed services were represented. Response rates were 83% overall, 82% for men, and 86% for women. Veterans were interviewed for an average of 5 hours, with a resulting wide assessment of prewar background, military and warzone experiences, as well as postwar life events, circumstances, and health

status. Further information on the sampling procedures and sample characteristics may be obtained from a number of sources (e.g., Jordan et al., 1991; Kulka et al., 1990; Schlenger et al., 1992; Weiss et al., 1992).

With listwise deletion, effective sample size for all analyses in the current study was 1,579, composed of 1,156 men and 423 women. Thus, missing data resulted in a loss of information for roughly 4% of the male veterans and 2% of the female veterans. Moreover, a *post hoc* comparison of the means of those with full data versus those with missing data on one or more study variables produced consistently nonsignificant differences with alpha level set at .05 for each contrast.

Measures

Combat Exposure. The combat exposure measure for the present study was constructed by King et al. (1995) using items from the "Vietnam Experience" portion of the NVVRS interview protocol. The 36 items measure the veterans' exposure to a variety of war-related events and circumstances, designated by King et al. (1995) as more "objective" incidents reflecting a traditional or stereotypical perspective on war experiences. The items were selected from an initial pool of 113 statements and confirmed as being the most representative of traditional combat stressors by a panel of six psychology graduate students and two clinical psychologists expert in the research on PTSD assessment and treatment. Sample items include: "How often did you fire a weapon?"; "How often were you under enemy fire?"; and "How often did you see Americans being killed or wounded?" Differences in the number of response options among the items required conversion to a common z-score metric, computed across scores for both genders. An overall or total score was then calculated as the sum across all item z-scores. Higher values are indicative of exposure to more intense combat. The scale has an internal consistency reliability of .94 and has demonstrated a strong relationship with PTSD for the NVVRS veterans (King et al., 1995, 1998; King et al., 1996).

Hardiness. Hardiness was measured using 11 items assessing the control, change as challenge, and commitment aspects that comprise the personality disposition construed by Kobasa (1979). The NVVRS primary researchers chose these specific items from the larger pool of items developed by Kobasa and colleagues. Sample items include: "Planning ahead can help avoid most future problems," "I feel uncomfortable if I need to make any changes in my everyday schedule," and "I really look forward to my work." A 4-point Likert scale (strongly disagree to strongly agree) accompanies each item. There is some controversy as to whether hardiness is a global unitary construct or whether it should be conceptualized in terms

of its three constituent features (e.g., Carver, 1989; Funk, 1992; Hull, Lehn, & Tedlie, 1991; Hull, Van Treuren, & Virnelli, 1987). In the present study, we chose to operationalize hardiness as a composite construct, given the limited number of available items. Therefore, all 11 item scores were summed to obtain a total score, with higher scores reflecting more hardiness. This scale has an internal consistency reliability of .73.

Social support. The current study used the 19 functional social support items identified by King et al. (1998). Thirteen of these items assess the individual's perceived availability of emotional sustenance (sample item: "Among your friends and relatives, is there someone you can count on to pick you up when you are feeling down?"). Six are indicators of perceived instrumental assistance (sample item: "Among your friends and relatives, is there someone who would lend you a car or drive you to a doctor, the airport, shopping, or somewhere else if you really needed it?"). Again, due to varying numbers of response options, item scores were transformed to z-scores, based on data from the full set of male and female veterans. A total score then was computed as the sum across all 19 item scores, since the emotional and instrumental aspects of social support were previously demonstrated to load on a single common factor (King et al., 1998). Higher scores indicate more perceived social support. This scale has an internal consistency reliability of .86.

PTSD. PTSD was measured using the Mississippi Scale for Combat-Related PTSD (Keane, Caddell, & Taylor, 1988). This 35-item instrument has a 5-point Likert format and assesses the reexperiencing, avoidance and numbing, and hyperarousal criteria for PTSD, in addition to related substance abuse, depression, and suicidality. The reliability and validity of the Mississippi Scale are well documented (e.g., King, King, Fairbank, Schlenger, & Surface, 1993; Kulka et al., 1990; McFall, Smith, MacKay, & Tarver, 1990; McFall, Smith, Roszell, Tarver, & Malas, 1990). The internal consistency of this scale for the Vietnam veteran participants in the NVVRS is .94.

Physical health conditions. NVVRS participants were asked to indicate which of a collection of physical health conditions had been problematic within the last 12 months. For men, there were 32 such conditions (1 gender-specific, related to the prostate); for women, there were 36 conditions (5 gender-specific, related to female reproductive ailments). A broad array of health problems was represented, including cardiovascular (e.g., high blood pressure), gastrointestinal (e.g., ulcers), respiratory (e.g., asthma), and musculoskeletal (e.g., permanent stiffness or any deformity of the foot, leg, or back) problems. An overall score was computed as an average of the number of conditions endorsed, dividing by 32 for men and 36 for women, thus creating comparable measures of overall health for both gen-

ders. This strategy seemed preferable to eliminating noncommon gender-specific ailments because of their high prevalence and importance to health. Higher scores were taken as indicative of poorer physical health.

Functional health status. The functional health status measure consisted of 14 items evaluating the veteran's ability to perform tasks and activities associated with daily living. Sample items from this scale are "Do you need help with eating, dressing, bathing, or using the toilet because of your health?" and "Do you have trouble bending, lifting, or stooping because of your health?" Each item was scored 0 if the veteran indicated he or she needed no assistance; 1 if the veteran was limited in performing the activity for 3 months or less; and 2 if the veteran was limited in performing the activity for longer than 3 months. A total score across all 14 items was obtained, with higher scores indicating more severe and chronic functional disability. The estimate of internal consistency reliability for this measure was .88.

Age and education. The veteran's age and level of education (scaled in values of 1 to 5 by the primary NVVRS researchers) at the time of data collection were also included as control variables. The use of these particular control variables parallels the approach of Wolfe et al. (1994) and Friedman and Schnurr (1995).

Analyses

First, descriptive statistics and bivariate correlations were computed. In addition, a multivariate test of differences between men and women was performed, incorporating the two covariates (age and education) and the other six variables of interest (combat exposure, hardiness, social support, PTSD, physical health conditions, and functional health status). This procedure was followed by Box's *M* test to examine the equivalence of the observed variance-covariance matrices among all eight variables across genders and then independent *t*-tests to pinpoint the source(s) of gender-based differences in group means.

The path-analytic strategy followed. A series of hierarchically-nested, ordinary-least-squares multiple regression analyses was employed separately for males and females to estimate the direct and indirect effects among variables. In each equation, age and education were entered as covariates. The series began with the most distal point in the set of relationships, with hardiness regressed on or predicted by combat exposure and the two covariates. The next equation involved the regression of social support on hardiness, combat exposure, and the two covariates. The sequence of equations continued, with the final regression equation having functional health

Table 1. Means and Standard Deviations for All Variables

Variable	Men (n = 1,156)			Women (n = 423)		
	M	*SD*	Range	*M*	*SD*	Range
Age	41.54	5.32	32–70	46.39	8.13	36–71
Education	2.79	1.00	1–5	3.75	1.11	2–5
Combat exposure[a]	0.12	0.63	-.89–2.13	-0.32	0.25	-.87–.68
Hardiness	33.20	3.81	19–44	34.84	3.70	23–44
Social support[a]	-1.06	10.93	-51.95–14.51	3.00	7.61	-51.95–15.18
PTSD	75.97	22.35	36–169	63.05	17.26	37–172
Physical health conditions[b]	0.04	0.05	.00–.33	0.06	0.06	.00–.47
Functional health status	2.48	4.67	0–28	2.90	4.81	0–28

[a]Means were computed on sums of scores for items that had been transformed to standard or z-scores; z-scores were computed using data from the combined male and female subsamples, with each item thus having a mean of 0 and an *SD* of 1. The negative values for the mean of men on social support and for the mean of women on combat exposure are consequences of the group or subsample means being below the grand mean (average total score across all participants).

[b]Means for physical health conditions are computed over average item scores, where each item is scored 0 or 1. Thus, the average number of physical health conditions for men was .04 × 32 items, or 1.28; the average number of physical health conditions for women was .06 × 36 items, or 2.16.

status predicted by physical health conditions, PTSD, social support, hardiness, combat exposure, and the two covariates.

The most saturated model, containing paths reflecting all 15 hypothesized relationships, was simplified by deleting paths represented by coefficients that did not reach the conventional .05 level of significance. The acceptability of the resulting parsimonious models for men and women was determined by comparing them with their respective saturated models using the Kim and Kohout's large-sample chi-square statistic (Land, 1973). A nonsignificant value for this chi-square provides evidence that the more parsimonious and constrained model does not differ from the more saturated model; the law of parsimony, that the simplest explanation is the preferred one, mandates endorsement of the more constrained model with fewer paths. Finally, for those paths that were common to men and women in their respective final models, tests of the significance of the difference between independent regression weights were conducted to determine if the relationships in the models differed as a function of gender.

Results

Table 1 presents the means, standard deviations, and ranges for all variables, for each gender. With regard to gender-based differences in means, the multivariate test incorporating all variables produced an exact

Table 2. Intercorrelations among Variables

Variable	1	2	3	4	5	6	7
Men (n = 1,156)							
1. Age	—						
2. Education	.13***	—					
3. Combat exposure	-.11***	-.05	—				
4. Hardiness	.17***	.12***	-.13***	—			
5. Social support	.13***	.03	-.31***	.39***	—		
6. PTSD	-.24***	-.15***	.50***	-.49***	-.63***	—	
7. Physical health conditions	.11***	-.00	.26***	-.20***	-.25***	.37***	—
8. Functional health status	.08**	-.03	.20***	-.20***	-.23***	.34***	.61***
Women (n = 423)							
1. Age	—						
2. Education	.02	—					
3. Combat exposure	-.08	.19***	—				
4. Hardiness	.10*	.11*	.02	—			
5. Social support	.26***	-.02	-.11*	.38***	—		
6. PTSD	-.14**	.02	.28***	-.47***	-.64***	—	
7. Physical health conditions	.21***	.09	.19***	-.04	-.08	.24***	—
8. Functional health status	.25***	.03	.17***	-.07	-.06	.21***	.56***

*p < .05.
**p < .01.
***p < .001.

$F(8,1570) = 79.80$, $p < .001$. Box's M test for gender-based differences in variance-covariance matrices also yielded a significant test statistic, $F(36, 2281860) = 20.172$, $p < .001$. Follow-up univariate t-tests with heterogeneous variances generated seven significant differences. Men scored significantly higher than women on combat exposure, $t(1563.34) = 19.63$, and PTSD, $t(965.79) = 12.12$, both $p < .001$. Women scored significantly higher than men on the two covariates, age, $t(559.64) = -11.40$, and education, $t(687.74) = -15.71$; on the two personal resource variables, hardiness, $t(770.31) = -7.74$, and social support, $t(1075.79) = -8.28$; and on physical health conditions, $t(634.38) = -4.75$, all $p < .001$. The difference in means for functional health status was nonsignificant, $t(731.31) = -1.55$, ns). Thus, there was a great deal of evidence to support differences between men and women on the means of and relationships among the variables under study.

Matrices of bivariate correlations among variables are provided in Table 2. In general, relationships were stronger for male veterans than for female veterans. For men, 24 of the 28 bivariate correlations were significant. For women, 17 of the 28 were significant.

The results of the hierarchically nested multiple regression analyses for the initial most saturated model for men and women are displayed in

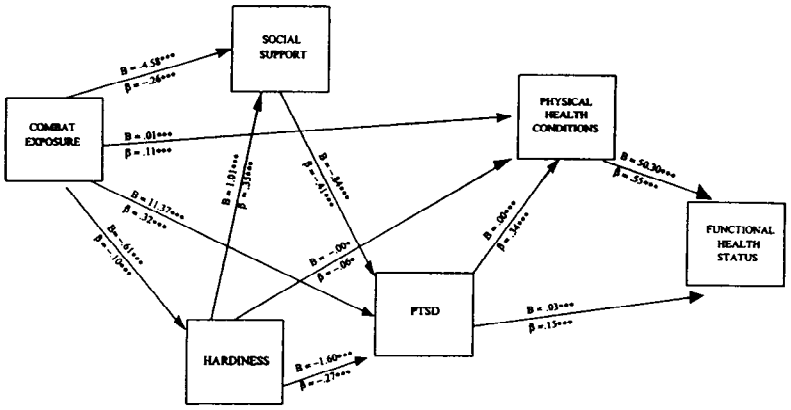

Figure 1. Final model for men, with standardized and unstandardized path coefficients corrected for age and education (*$p < .05$; **$p < .01$; ***$p < .001$).

Table 3. Rows in the table correspond to equations in the sequence, beginning with the regression of hardiness on combat exposure and both covariates and ending with the regression of functional health status on all other variables. Each equation yields path coefficients addressing postulated relationships. When nonsignificant paths were deleted, the more parsimonious and accepted model for men was that depicted in Figure 1; the corresponding model for women is depicted in Figure 2. The large-sample chi-square statistics representing the comparison of each of these restricted

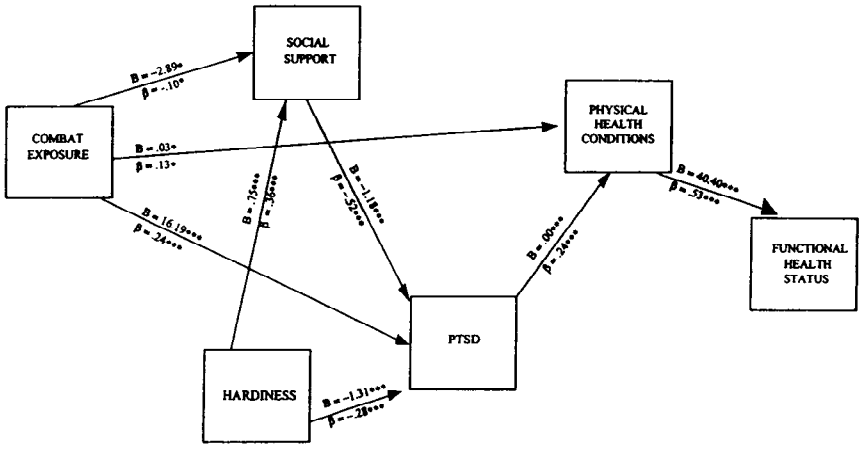

Figure 2. Final model for women, with standardized and unstandardized path coefficients corrected for age and education (*$p < .05$; **$p < .01$; ***$p < .001$).

Table 3. Hierarchically Nested Regression Analyses for Men (n= 1,156) and Women (n= 423)

	Covariates		Predictor Variables					
Criterion Variable	Age	Education	Combat	Hardiness	Social Support	PTSD	Physical Health Conditions	R^2
Hardiness								
Men	.100*.021 (.14)	.379*/.111 (.10)	-.609*/.176 (-.10)					0.05
Women	.047*/.022 (.10)	.332*/.163 (.10)	.220/.715 (.02)					0.02
Social support								
Men	.088/.054 (0.4)	-.311/.285 (-.03)	-4.578*/.456 (-.26)	1.007*/.075 (.35)				0.22
Women	.206*/.041 (.22)	-.301/.303 (-.04)	-2.892*/1.328 (-.10)	.746*/.090 (.36)				0.21
PTSD								
Men	-.410*/.081 (-.10)	-1.704*/.429 (-.08)	11.368*/.712 (.32)	-1.601*/.121 (-.27)	-.835*/.044 (-.41)			0.58
Women	.106/.074 (.05)	-.212/.534 (-.01)	16.190*/2.348 (.24)	-1.311*/.171 (-.28)	-1.184*/.085 (-.52)			0.53
Physical health conditions								
Men	.002*/.000 (.22)	.002/.001 (.03)	.009*/.003 (.11)	-.001*/.000 (-.06)	-.000/.000 (-.01)	.001*/.000 (.33)		0.19
Women	.002*/.000 (.25)	.003/.003 (.04)	.030*/.012 (.12)	.000/.000 (.05)	.000/.001 (.04)	.001*/.000 (.29)		0.14
Functional health status								
Men	.054*/.021 (.06)	-.058/.110 (-.01)	-.122/.202 (-.02)	-.029/.033 (-.02)	-.005/.013 (-.01)	.029*/.008 (.14)	50.364*/2.338 (.55)	0.39
Women	.103*/.025 (.17)	.090/.177 (.02)	1.355/.820 (.07)	-.054/.060 (-.04)	.002/.034 (.00)	.022/.016 (.08)	37.357*/3.242 (.49)	0.35

Note. Unstandardized regression coefficients with t statistics exceeding approximately 1.96 are significant, $p < .05$, and are identified with a single asterisk (*). Values for standardized regression coefficients appear prior to the slash (/), and their standard errors appear after the slash. Values for the standardized coefficients (βs) are provided in parentheses.

models with their corresponding most saturated model were as follows: for men, $\chi^2(4, n = 1156) = .40, p = .98$, and for women, $\chi^2(7, n = 423) = 1.55, p = .98$). Thus, the constraints imposed in the final accepted model for each gender did not significantly reduce the fit to the data when compared with the most saturated model, indicating that the more parsimonious and restricted models are preferred.

As shown in Figures 1 and 2, eleven of the 15 postulated relationships were retained for men and 8 of the 15 were retained for women. All eight paths in the model for women were present in the model for men, and tests for the equality of independent unstandardized regression coefficients (Cohen & Cohen, 1983, p. 111) for these paths indicated four gender-based differences: The paths from hardiness to social support and from physical health conditions to functional health status were stronger for men than for women, $z = 2.24$ and $z = 2.56$, respectively, both $p < .05$. The paths from combat exposure to PTSD and from social support to PTSD were stronger for women than for men, $z = -1.97$, $p < .05$, and $z = -3.64$, $p < .001$, respectively.

Finally, Table 4 contains standardized total, direct, and indirect effects of relevant variables on PTSD, physical health conditions, and functional health status, computed from the standardized path coefficients reported in Figures 1 and 2. As noted there, all total, direct, and indirect effects were significant for both genders.

Discussion

The first general set of hypotheses for this study concerned hardiness and social support as mediators of the combat exposure–PTSD relationship and the combat exposure–physical health conditions relationship. As expected, both personal resource variables partially mediated the association between combat exposure and PTSD for men (see Figure 1); the indirect effect of combat exposure on PTSD, through hardiness and social support, was somewhat less than its direct effect (see Table 4). For women, however, there was no link between combat exposure and hardiness, and partial mediation of the combat exposure–PTSD relationship occurred only through the social support variable (see Figure 2). As shown in Table 4, the indirect effect of combat exposure through social support for women, though achieving the conventional standard of significance, was substantially less than its direct effect. In the models for both genders, combat exposure was directly associated with PTSD, an expected finding consistent with an abundance of research on war-related stress (e.g., Fairbank, Schlenger, Caddell, & Woods, 1994; Foy, Sipprelle, Rueger, & Carroll, 1984; Green, 1994; Kay-

Table 4. Standardized Total, Direct, and Indirect Effects

Variable	Effects on PTSD			Effects on Physical Health Conditions			Effects on Functional Health Status		
	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect
Men									
Combat exposure	.48	.32	.15	.26	.11	.15	.16	—	.16
Hardiness	−.41	−.27	−.14	−.20	−.06	−.14	−.11	—	−.11
Social support	−.41	−.41	—	−.14	—	−.14	−.14	—	−.14
PTSD				.34	.34	—	.34	.15	.19
Physical health conditions							.55	.55	—
Women									
Combat exposure	.29	.24	.05	.20	.13	.07	.11	—	.11
Hardiness	−.47	−.28	−.19	−.11	—	−.11	−.06	—	−.06
Social support	−.52	−.52	—	−.12	—	−.12	−.07	—	−.07
PTSD				.24	.24	—	.13	—	.13
Physical health conditions							.53	.53	—

Note. All direct and indirect effects are significant, $p < .05$; also see Figures 1 and 2.

lor, King, & King, 1987; March, 1993). For men, the total effect of combat exposure on PTSD was larger than the total effects of the personal resource variables. For women, the opposite obtained (see Table 4).

Concerning hardiness and social support as mediators of the combat exposure–physical health conditions relationship, Figures 1 and 2 reveal no path between social support and physical health conditions for either gender, no path between hardiness and physical health conditions for women, and a relatively weak path between hardiness and physical health conditions for men. Thus, the function of the personal resource variables as mediators in terms of links from combat exposure and then directly to physical health conditions is marginal, and the relationship of these variables with physical health conditions is predominantly through their associations with PTSD. A recently introduced theoretical model by Resnick, Acierno, and Kilpatrick (1997) likewise emphasized risk for mental health disorders (here, PTSD) as a major mediator between incident(s) of violent assault and increased health problems. Moreover, consistent with previous research (Friedman & Schnurr, 1995; Wolfe et al., 1994), and as shown in Table 4, the total effect, as well as the direct effect, of combat exposure on physical health conditions is secondary to the effect of PTSD on physical health conditions.

It appears that there is support for the Kaniasty-Norris (1993; Kaniasty et al., 1990; Norris & Kaniasty, 1996) deterioration model regarding mediational patterns from stressors through personal resources to health variables. Indeed, in three out of four cases, the stressor appeared to have a potential effect of diminishing personal resources, as represented by the negative associations between combat exposure and social support for both men and women and between combat exposure and hardiness for men (see Figures 1 and 2). Clearly, those charged with providing mental or physical health services for people suffering traumatic experiences and their sequelae must be alert to the possibility that interpersonal and intrapersonal strengths are subject to erosion. Restructuring and replenishing such assets may be valuable.

Our expectation regarding a simple mediational role for hardiness and social support in accounting for the combat exposure-functional health status relationship was not upheld. Essentially, these variables did not display a direct connection to functional health status in either the model for men (Figure 1) or the model for women (Figure 2). Again, however, PTSD appeared to be a pivotal variable. For male veterans, in particular, the total effect of PTSD on functional health status was fairly substantial, and for both genders, physical health conditions had a high association with functional health status (Table 4). These findings are in accord with some previous work (e.g., Hays, Wells, Sherbourne, Rogers, & Spritzer, 1995; Lyness et al., 1993; Wells, Gold-

ing, & Burnham, 1988) suggesting that psychiatric illness and physical illness are both important in predicting functional disability.

As pointed out previously, the bivariate correlations among the variables in this study were generally weaker for female than for male veterans. Figures 1 and 2 show 11 significant paths in the model for men but only eight in the model for women; four of the path coefficients common to both models differed significantly. Yet, both models clearly demonstrate that the personal resource variables operate mainly through PTSD. Furthermore, if one focuses specifically on the associations among combat exposure, PTSD, and physical health conditions, then the results reported here extend the work of Wolfe et al. (1994) and Friedman and Schnurr (1995) by highlighting PTSD's mediational role for male and female veterans.

Given that PTSD emerged as a critical mediator in this study, an avenue for additional research may be identification of more specific mechanisms by which this condition relates to physical health problems and ultimately in possible functional disability. For example, in ongoing research examining trauma, PTSD, and physical health in elderly veterans, Schnurr, Aldwin, and Spiro and their associates (1997) are concentrating on adverse health behaviors that explain the translation of PTSD symptomatology into health-related morbidity. Their behavioral mediators include alcohol abuse and smoking. Complementary research might focus on other adverse health behaviors, such as eating disorders in female trauma victims. Moreover, PTSD in assaulted women may be viewed as a precursor to risky sexual behaviors that exposes them to HIV and other sexually transmitted diseases, as exemplified in the current work of Resnick and Kilpatrick and their colleagues (1996).

The significance of trauma and PTSD to physical health conditions and functional health status may have important implications for clinical interventions. Screening for extremely stressful life events and possible signs of posttrauma symptomatology would appear to be a worthwhile endeavor within comprehensive medical practices. This is especially appropriate given the well-documented high rates of trauma exposure in various community-based populations (e.g., Breslau, Davis, Andreski, & Peterson, 1991; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995; Vrana & Lauterbach, 1994) and the concomitant high prevalence of persistent PTSD in the general population (Kessler et al.). Also, clinicians engaged in the treatment of trauma victims should be cognizant of the vulnerability of their patients to physical ailments and associated diminution of ability to perform daily tasks that directly affect overall quality of life.

A strength of this study lies in the quality of the sample and the associated generalizability of findings. Response rates were extraordinarily high (82% for men and 86% for women). In addition to including both

male and female veterans, the NVVRS sample was diverse in age, ethnic composition, geographical representation, military service affiliation, and trauma exposure. One must be cautious, however, in any study such as this that employs a cross-sectional design and includes retrospective accounts of events that occurred at least a decade earlier. Though our model specification relied on substantive considerations and a chronologically based sequencing of variables, we recognize that the direction of the relationships postulated in the path analysis can be fully supported only by the use of longitudinal data. The study might also be challenged for its reliance on self-report measures, especially self-reports of physical health conditions. As Friedman and Schnurr (1995) discussed, however, self-report measures have often been found to be strong indicators of health and well-being (Solomon, Mikulincer, Freid, & Wosner, 1987; McHorney, Ware, Rogers, Raczek, & Lu, 1992). In addition, investigators have shown that self-reports of health are strong correlates of objective measures of health and predict subsequent functional health status, morbidity, and mortality better than medical records (Idler & Kasl, 1991; LaRue, Bank, Jarvick, & Hetland, 1979; Mossey & Shapiro, 1982). King and King (1991) and King et al. (1995) provided a more detailed presentation of potential threats to validity in cross-sectional, retrospective studies using self-report data, with special focus on Vietnam veteran research.

In closing, it may be important to note that the participants in the NVVRS and the population that they represent are now in their middle years and will soon be senior citizens. The documentation of a relationship between PTSD and physical health outcomes seems particularly salient at a time when health problems attributable to aging are anticipated. It is vital that health care professionals be aware that PTSD may exacerbate physical illness, disease, and disability, and that mental health personnel endeavor to make appropriate referrals for concomitant medical services.

Acknowledgments

The authors thank Kimberly A. Wilson for her careful review of earlier versions of this manuscript.

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